

**THE ADVANTAGES OF THE MIKULICZ TWO-STAGE OPERATION
OF PARTIAL COLECTOMY**

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THE early intestinal resections were largely done by the help of temporary artificial ani. As surgery progressed the elements which control sepsis were better understood and the wonderful healing power of the intestine was better appreciated. Immediate suture was successfully practiced and the one-stage operation became the procedure of choice either with immediate closure of the wound or with provision for drainage. An immediate healing with prompt restoration of function is surely more desirable than a delayed union and the discomforts of even a temporary intestinal stoma.

There are, however, certain advantages inherent in the two-stage operation. In 1902 Mikulicz formulated these advantages, described the operation which ordinarily bears his name and recorded cases which showed remarkable reduction in mortality rate. He had then used the procedure for more than five years. He thoroughly mobilized the portion of intestine which was to be removed and delivered it through the abdominal wound after stitching together the serous surfaces of its afferent and efferent portions. He then closed the incision to the emergence of the intestine, stitched the skin edges to the intestinal wall and applied protective ointment and a surgical dressing over the incision. This was all accomplished without opening the intestine. He either left the extruded portion in the dressing to be removed at a later time or excised it at once and provided for drainage at a safe distance from the wound. A temporary stoma was left. The "spur" was clamped through at a later time and then the intestinal ends brought together by suture.

Many surgeons have adopted this operation on account of its diminished mortality rate. However, the records published in surgical literature indicate that it is only used in a moderate portion of those cases for whom it might be considered suitable. For instance, in the last ten volumes of the ANNALS OF SURGERY we find records of 26 operations for obstructive disease of the colon. They were distributed as follows:

End-to-end suture	9
Lateral anastomosis	7
Short circuiting	6
Mikulicz operation	2
Exploratory operation	1
Colostomy	1

If we study the 32 cases of cancer of the splenic flexure which Hartwell collected from the literature from 1906 to 1918, we find the following records:

Mikulicz, or similar procedure	9
Lateral anastomosis	7
End-to-end suture	5
Short circuiting	3
Colostomy	6
Colostomy with extirpation of tumor	1
End-to-side anastomosis	1
Inoperable cases	6

These reports show great diversity of method and suggest the desirability of further consideration of certain elements which bear on the relative advantages of one-stage operations and two-stage operations when portions of the intestine are to be removed. These elements are:

1. Septic intestinal content.
2. Extent of peritoneal intestinal covering.
3. Condition of patient.
4. Peritoneal sepsis.
5. Conservation of nutrition.
6. Skin irritation from leakage of intestinal content.
7. Reflex effect of fastening different parts of the intestine to the abdominal wall.

These elements differ in different parts of the intestine and in different patients.

Small Intestine.—The small intestine presents elements which favor one-stage operation in almost all instances. The intestinal content is fluid and, ordinarily, is rapidly moving and has little septic power. The peritoneal covering is close to the muscular wall of the intestine excepting at the small mesenteric border and hence gives abundant opportunity for strong opposition. Cancer is rare here and hence we do not often have to deal with debilitated patients. Furthermore, the disadvantages of the two-stage operation apply to the small intestine with especial force. Inanition results from too much intestinal leakage. Skin irritation, or even skin digestion, follow the leakage of fluid which still has digestive power. The reflex disturbance from fixation is greater from the small than from the large intestine. Hence the two-stage operation is only applicable to the small intestine in especial emergencies. For instance, strangulated hernia with gangrene of the intestine and spreading infection of the adjacent tissues.

Ileo-cæcal Region.—At the ileo-cæcal region the conditions still favor the one-stage operation. The intestinal content is still fluid, it has only moderate infective power and ordinarily moves with fair rapidity. The peritoneum of the ileum is close to the muscular coat excepting at the mesenteric border, and the peritoneum of the large intestine gives abundant opportunity for serous apposition of either lateral or end-to-side anastomosis. Provision for possible leakage is easily obtained.

Colon; Hepatic Flexure to Terminal Sigmoid.—The colon from the hepatic flexure to the terminal sigmoid is the region for which the two-stage operation is especially considered. This region furnishes nearly 70 per cent. of the intestinal cancers above the rectum.¹ Here we have an intestinal content which is semi-solid, or possibly solid. It holds vast numbers of bacteria. Mayo states that it has been shown that one-quarter to one-third of the stool bulk is due to bacterial growth. Partial obstruction exists in a large proportion of the cancers of this region which come to operation, hence this septic intestinal content cannot be satisfactorily eliminated and forms a serious menace to satisfactory healing.

The peritoneal covering is frequently defective. This defect in the upper part of the descending colon is due to the anatomical arrangement which usually leaves the posterior portion of the gut uncovered by peritoneum. However, the deposit of fat between the peritoneum and the muscular coats of the intestine is sometimes the main barrier to satisfactory serous apposition. In the sigmoid and descending colon one frequently notices at operation that the strip of peritoneum which lies close to the muscular wall is only one-half to three-quarters of an inch in width and that there is a thick deposit of fat elsewhere. This fat deposit is shown in the appendices epiploici, but in many instances is massive and really envelops a large part of the intestinal wall. Of course, in those patients who are debilitated by cancer it has usually been absorbed, but some patients come to operation in whom it is still present, hence operation must be planned with the understanding that fat deposit may hamper serous apposition of the divided intestinal ends.

The condition of the patient may be a strong barrier to a successful one-stage operation. The majority of these patients suffer from cancer and have suffered for a long time before they come to operation. They have little resisting power and hence operative procedure must be planned so that they will not have more than they can endure.

Peritoneal sepsis does not often come in these patients, but a perforation is occasionally found which leads to considerable peritoneal sepsis and hence forbids a type of anastomosis which otherwise might be made.

The interference with nutrition, the skin irritation and the reflex effect of fastening the intestine to the abdominal wall are all minimized in the two-stage operation on the colon as compared with the small intestine.

We therefore have many reasons why a two-stage operation should be used in a large number of partial colectomies.

Statistics Comparing Results of Different Types of Operation.—If we study records of operations we find further reason for using the two-stage procedure. Mikulicz² emphasized the advantages of this procedure and gave detailed reports of its efficiency in the Breslau clinic. The mortality of intestinal resections by the one-stage operation was 42.9 per cent., whereas by his two-stage operation he did sixteen cases

with only two deaths—a mortality of $12\frac{1}{2}$ per cent.—and these two deaths were not, primarily, due to the operation.

The procedure has been much used in the intervening years. Oppel³ quotes Finkelstein as showing in the collective study of results that the mortality of the one-stage operation had been 29 per cent., and that of the Mikulicz two-stage operation had been 16 per cent.

Mayo⁴ states that the adoption of the Mikulicz-Bruns method has probably done more to extend operability and reduce mortality in resections in the second half of the colon than any other factor. By adopting this method in a large proportion of the operations he resected the left half of the colon, including the splenic flexure but not including the rectum, 184 times, with a mortality rate of 17 per cent.

Hartwell's⁵ recent study of cancer of the splenic flexure is very important, although discouraging. After a careful study of the literature, he estimates that the probable operative mortality of all cases, up to the present time, is over 60 per cent. But the results from operation in many stages is much better than that in one stage. He states that his "collected cases show a mortality approximately three times greater in the one-stage than in the many-stage procedure. Careful study indicates that the failures in the one-stage operation would have been avoided by the other mode of attack. These failures arose almost entirely from leakage somewhere along a suture line, with a resultant peritonitis or improperly drained abscess."

The late James P. Tuttle once told me that he had successfully done five successive partial colectomies by the Mikulicz method, whereas his previous mortality rate, in similar conditions by other methods, had been 33 per cent.

We thus see that there are abundant records to show that the two-stage or many-stage operation has a much lower mortality rate than the one-stage operation.

Record of Personal Operations.—The author's early cases were mostly admitted to the hospital on account of symptoms of obstruction. It was not always possible to secure satisfactory cleansing of the intestine. Anastomosis with immediate return of the intestine to the abdomen was sometimes successful and satisfactory, but, even in those patients in whom a preliminary colostomy was done, there were enough failures to lead to a search for a better method. The following cases illustrate the use of the Mikulicz method. The mortality rate, one in eight, is much better than that obtained by immediate suture.

CASE I.—*Adenocarcinoma of sigmoid.* A. L., aged fifty-one years. Roosevelt Hospital, No. A15023. Operation March 29, 1919. Fourteen months previously he had had an abscess beside the descending colon which had healed but had again been opened in February, 1919. At operation, an adenocarcinoma was found in the upper part of the sigmoid. This was mobilized and the diseased

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part of the intestine was delivered through the abdominal incision. The procedure was much hampered by the presence of the discharging sinus. A loop of small intestine was adherent to the sigmoid and was necessarily exposed to the infection from this sinus. It was, however, returned to the abdominal cavity. The diseased portion of the colon was delivered through the abdominal wound. Wound closed to the point of emergence after the afferent and efferent legs of intestine had been united. The wound was protected by ointment and gauze, protruding portions of intestine double ligated at a distance from the skin edges, tumor excised outside of primary dressing. Exposed mucous membrane cauterized. Ligatures cut forty-eight hours later. The patient died of general peritonitis six days later. His death was apparently due to infection from the sinus and attached coil of small intestine which had come in contact with it.

CASE II.—*Adenocarcinoma of descending colon.* Mrs. F. I., aged sixty-five years. One-year intermittent pain in left side. Worse of late. Had lost 25 pounds in weight. Palpable mass in left side of abdomen. Operation June 29, 1918. Intermuscular incision above and in front of anterior superior spine of ilium. Descending colon mobilized and delivered through the wound. Annular growth just above the sigmoid. Serous surfaces of afferent and efferent portions united with catgut. Wound closed to the emergence of intestine. Intestine stitched to skin; also further secured by tape. Ointment and surgical dressing applied over the wound. Protruding intestine double ligated. Diseased portion ablated external to the ligatures. Mucous membrane cauterized and secondary dressing applied. Ligatures removed on second day. Spur clamped in two weeks.

Second operation July 30, 1918. The operation was done in an adjoining city and patient had not been seen by the author since the primary operation. A clamp was applied to that portion of the spur which still remained. The intestinal edges stitched together to the emergence of this clamp and the union was reinforced by stitches through the fascia and skin. The wound closed promptly excepting for a very small sinus. The sinus soon closed completely. She made an excellent recovery and is now in good health with no evidence of recurrence.

CASE III.—*Adenocarcinoma of transverse colon.* J. D., aged fifty-three years. Roosevelt Hospital, No. A14317. Eleven months' history of cramp-like pains intermitting and recurring. Loss of weight, 15 pounds. April 15, 1918, partial colectomy through an incision in upper right rectus. Gastro-colic omentum separated from greater curvature of stomach. Growth mobilized and delivered; serous surfaces of afferent and efferent legs united with catgut. Wound closed to emergence of intestine. Skin stitched to intestinal wall. Dressing applied to abdominal wound. Clamps applied to intestine leaving about one and one-half inches between the clamps and abdominal wound. Clamps removed in thirty-six hours.

There was satisfactory healing, but the patient was much debilitated and did not gain strength rapidly. Clamp applied to spur May 3. Attempt to close stoma by loosening the attachments and applying stitches in layers May 18. This was only partially successful and was repeated June 24. After this there was slight leakage, but the wound was entirely closed on September 3, and the patient has remained in excellent health ever since. Has done routine duty as policeman, and is now in excellent health.

CASE IV.—*Adenocarcinoma of descending colon.* Mrs. T., aged fifty-two years. Roosevelt Hospital, No. A14356. Abdominal pain, colic, vomiting recurring in intermittent attacks six weeks or more. Operation May 11, 1918. Long incision through the left rectus muscle. An annular constricting adenocarcinoma was found in the descending colon just below the level of the costal border. This and the adjoining portion of the intestine were mobilized and delivered through a second, left intermuscular incision. Serous surfaces of afferent and efferent legs united with catgut. Wound closed to the emergence of intestine. Skin edges stitched to intestinal walls. Intestine further held by glass rod. Wound dressed with ointment and gauze. Intestine double ligated outside the layers of gauze. Tumor and adjoining intestine ablated. Mucous membrane cauterized. Further dressing applied. Two days later the constricting ligature was removed from the afferent intestine; satisfactory intestinal stoma established. Spur clamped in two weeks. Colostomy opening closed in layers July 22. Patient left hospital September 12. All steps in her procedure were slow on account of her weakened condition. Wound closed satisfactorily, and she remains in excellent health at the present time.

CASE V.—*Colloid carcinoma of descending colon.* Mrs. E. W., aged thirty-two years. Roosevelt Hospital, No. A8521. Four months' history of cramp-like pains in abdomen and back. Operation May 9, 1917. Growth and adjoining portion of descending colon mobilized and brought through left abdominal wound. Serous surfaces of afferent and efferent legs joined with catgut. Wound closed to emergence of intestine. Skin edge stitched to intestine. Intestine further stabilized by glass rod. Two ligatures applied outside the dressing. Intestine excised outside the ligatures. Mucous membrane cauterized. Ligatures removed two and three days after operation. Suitable stoma established. Spur clamped two weeks after operation. Ends of intestine united June 12. Patient left hospital, with wound healed, June 30.

CASE VI.—*Adenocarcinoma of sigmoid.* Mrs. A. G., aged thirty-nine years. Roosevelt Hospital, No. A6340. Operation June 19, 1915, for a recurring cancer of the sigmoid. Intestine mobilized. Afferent and efferent legs united with catgut. Mobilized portion delivered through the left intermuscular incision. Skin edges stitched to intestinal wall. Dressing applied. Intestine double ligated outside the primary dressing. Ligatures about afferent end of intes-

tine removed in forty-eight hours. Stoma established. Spur clamped in about two weeks. Ends of intestine sewed together July 29. Patient left hospital, with stoma closed, August 15.

CASE VII.—*Extensive tuberculosis of caput coli and lower ileum.* B. S., aged thirty-five years, General Memorial Hospital, December 12, 1912. One-stage operation not done on account of infection which was present. Mikulicz procedure with immediate removal of diseased intestine. Stormy convalescence owing, in large measure, to illness not connected with the intestine. Spur cut down; stoma closed. Patient left hospital after two months and made excellent recovery after three additional months of treatment, and remains well at the present time.

CASE VIII.—*Diverticulitis. Perforation. Abscess formation.* C. A., aged sixty-four years, Roosevelt Hospital, No. B3281. Three months intermittent, left abdominal pain and constipation. Large palpable mass in left side of abdomen. Operation September 13, 1912. Large mass, composed of perforated descending colon and encapsulating omental and pericolic fat, mobilized and delivered through left lateral incision. Serous surfaces of afferent and efferent intestine stitched together with catgut. Abdominal incision closed to the emergence of the intestine. Skin edges stitched to intestine and retaining tape placed between the intestinal loops. Dressing applied. Ligation of protruding intestinal loops outside of primary dressing. Ablation of inflammatory mass. Exposed mucous membrane cauterized. External dressing applied. Ligature removed after seventy-two hours and stoma established. Part of spur clamped on fifth day to seventh day. Remaining spur clamped at a later time. An effort was made to close the stoma October 13. This was successful excepting for a small fistula which was closed on November 3. Patient left hospital on December 14 with wound satisfactorily closed.

This series of cases is too small for extensive deductions, but it is sufficient to indicate that the Mikulicz procedure is far safer in the colon than the one-stage procedure. The low mortality rate—12½ per cent.—corresponds to that of other operators. The one fatal case was due to a rare complication; we do not often find an open sinus and a loop of small intestine adherent to the infected area.

Of course, delay in healing, unpleasant convalescence and probability of hernia constitute the main barriers to this procedure. In this series the delay has often been longer than was absolutely necessary. While a debilitated patient is gaining strength steadily, but slowly, one hesitates about even moderate surgery when a little longer waiting is sure to make the closing of the stoma easier. Absence from the city also occasioned delay in some instances. Mayo begins the clamping of the spur ten or twelve days after the primary operation and expects its division to be complete in six more days. "A few days later the resulting colostomy can be closed by a simple extra-peritoneal operation." In two of my cases the healing was complete in respectively six and one-

half and nine and one-half weeks. In five cases small sinuses remained for three to five months before final healing occurred. These were not enough to occasion serious inconvenience and the patients preferred delay to further stitching. When we appreciate the greater safety, we may be sure that most patients would be willing to purchase this safety by a delay in convalescence and the associated discomforts.

Final Results.—Proper mobilization of the desired portion of the intestines is the first element in obtaining good final results. If the adjacent tissues or lymph-nodes are involved, they, too, are to be removed when possible. This is done without regard to the method of excision. Considering the increased percentage of recoveries, the final results of the two-stage operation are much better than those of the one-stage operation.

Applicability of the One-stage Procedure.—Without doubt, there are patients in whom the one-stage operation can be successfully done. Such patients should be fairly strong and their colons should be nearly empty and should be comparatively free from fat. Before deciding to use this method, one may well remember the brilliant results which Mayo and Mikulicz have obtained by the two-stage procedure, and Hartwell's studies which show that the one-stage procedure has had a mortality rate three times greater than the many-stage method.

It is not my purpose to advocate the two-stage procedure for all cases, but rather to call attention to its advantages and to urge its use in the average case as it now comes to us in the hospital, reserving immediate suture in the colon for those patients who are especially fitted for it.

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